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DEVICE FOR ELECTRIC CONNECTION OF ELEMENTS ON THE STEERING WHEEL  
OF A MOTOR VEHICLE

[Einrichtung zum elektrischen Anschluss von Elementen  
am Lenkrad eines Kraftfahrzeuges]

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## Device For Electric Connection of Elements on the Steering Wheel of a Motor Vehicle

In a device for electric connection of elements that are mounted on a rotating part of the steering mechanism of a motor vehicle to the wiring of the motor vehicle by means of a transmission segment between a first part, which is connected to the rotating part of the steering mechanism, and a fixed second part, wherein the first part can be electrically connected to the elements and the second part can be connected to the wiring, the first part has a connection device with a suitable input and output unit, to which at least two of the elements can be mutually connected. The second part has at least one interface for the connection to the wiring of the motor vehicle. The connection device and the interface can be connected via the transmission segment for the multiplexed transmission of signals.

### Specification

The invention concerns a device for electric connection of elements, which are mounted on the rotating part of the steering mechanism of the motor vehicle, to the wiring of the motor vehicle by means of a transmission segment between a first part, which is connected to the rotating part of the steering mechanism, and a fixed second part, wherein the first part can be electrically connected to

the elements and the second part can be connected to the wiring. The elements to be connected comprise, for example, the airbag, a steering moment sensor, or control elements for the horn, a radio, or other devices connected to the wiring.

Another device is known, for example, from DE 4440889. There, a few elements that are mounted on the steering wheel by means of respective electric lines, which are spirally wound around the steering column, are connected to the onboard network of the motor vehicle. When the steering wheel moves within specific limits, the cables follow the rotary motion without being damaged.

However, with an increasing number of control elements and devices, which are to be mounted on the steering wheel of a modern motor vehicle, the costs and the construction volume of such a mounted device increase considerably. The connection of rotatable and fixed parts requires, in dependence upon the connected element, a least one to two lines. In addition, the assembly of a steering wheel provided with such a device is very complex, since all the lines must be connected to onboard network of the motor vehicle. It is also hardly possible to carry out upgrades on the connected elements without sizeable alterations.

It is an object of the invention to disclose a device for electric connection of elements on the steering wheel of a motor

vehicle, which has a small construction volume, can be economically produced, is easy to assembly, and is easy to upgrade.

This object is attained with the device according to the invention in that the first part has a connection device with a suitable input and output unit, to which at least two of the elements can be mutually connected, the second part has at least one interface for connection to the wiring of the motor vehicle, and the connection device and the interface can be connected via the transmission segment for the multiplexed transmission of signals. The construction volume for the transmission device can be considerably reduced by means of the transmission of signals of the connected elements via only a single transmission device.

For a complete mechanical decoupling of the two parts of the transmission device, it is provided in a first embodiment of the invention, that the transmission segment is formed by at least one set of magnetic, mutually coupled electric coils, of which at least one first coil can be connected to the connection device of the rotatable part and respectively at least one second coil can be connected to the interface of the fixed part. Electric signals can be transmitted by means of electric fields, which form between the coils, with the aid of the coils.

In a further development of the device according to the invention, it is provided that, aside from signals, also operating

energy can be transmitted via the transmission segment between the rotatable and the fixed part, the interface has connection possibilities to the wiring of the motor vehicle, and the connection device of the rotatable part has means for making available the operating energy to the connected elements. In this way can also be connected elements that consume energy.

If high energy fluxes are required or if particularly weak signals are transmitted, it is advantageous if the transmission segment has lines, whose first end can be connected to the connection device of the rotatable part and whose second end can be connected to the interface of the fixed part in such a way that the lines follow the rotary motion of the steering mechanism, for example, in that they are spirally wound around the steering column.

In a next further development of the invention, it is provided that signals and operating energy can be transmitted via the same coil set. In this way, the construction volume can likewise be reduced, since the remaining coil sets are eliminated.

In order to achieve a further reduction of the construction volume, it is provided in another further development of the invention that the housing of the airbag, which is integrated in the steering wheel, the carrier for a steering moment sensor, and the connection device form one structural unit.

Since an airbag of the motor vehicle requires a high ignition power, but the connection of the two parts of the transmission device can in some cases only transmit a low power, in a further development of the invention, the airbag can be provided with an energy store, which can be charged by means of a transferable operating energy, and which contains the necessary energy for the ignition of the airbag.

In order to attain an adaptation to modern bus systems, the interface is also configured for the transmission of digital signals and/or the interface can be connected to the bus system of the motor vehicle.

The invention makes possible numerous embodiments. One of these is shown schematically in the drawings, which include several figures and will be described in detail below. In the figures:

Fig. 1 shows a block circuit diagram of a device according to the invention; and

Fig. 2 shows the device according to the invention in installed status.

The same parts are identified with the same reference numerals.

Fig. 1 shows a device according to the invention as a block circuit diagram. A connection device receives signals from the connected elements and forwards the signals to these. A transmission segment 2 transmits signals and operating energy in both directions between an interface 3 and the connection device 1.

The signals transmitted by the elements connected via lines 4a are forwarded by an input and output unit 4 to a control unit 6, which is clocked by a clock generator 5, which converts the signals with the aid of a modulator/demodulator 7 into a serial signal, which contains the information of the signals. In the opposite direction, signals that are intended for connected elements are demodulated and forwarded by means of the input and output unit 4.

The serial signals are bidirectionally transmitted with the aid of two electric coils 2a' and 2a''. A further modulator/demodulator 9 receives or transmits the serial signals to the side of the interface 3. A distributor module 6', which is clocked by a second clock generator 5', distributes the demodulated signals via converter modules 10 to the lines 11 of the bus system of the motor vehicle or

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collects signals that are to be transmitted to the connected elements, and leads these to the modulator/demodulator 9.

In order to be able to supply the connected elements with operating energy, a further coil pair 2b' and 2b'' is provided in the example shown in Fig. 1, with whose aid electric energy is transmitted.

Supply voltage U is supplied via connecting contacts 12 to the interface 3 and reaches via a reverse battery protection 12a and a buffer condenser 12b to an inverter 12c. The output voltage of the



inverter is transmitted via the coil pair 2b', 2b'' and is made available after inversion at 13a and voltage stabilization at 13b to a connection contact 13. It was also possible to transmit the operating energy in addition to the useful signals with a mutual coil pair by means of a suitable modulation.

Fig. 2 shows a schematic illustration of the device in installed status. A steering moment sensor 21, which is mounted on a twistable support part 22 in the steering shaft 23, supplies measuring signals to the connection device 1, which is likewise located on the support part. The support part 22 is connected to the housing 24 for an airbag, which is integrated in the steering wheel 25 of a motor vehicle, and forms a structural unit therewith, which can be installed as a whole in the steering shaft 23. All of the control elements 27, which are mounted on the steering wheel 25, are connected via lines 28, 4a, 13 to the connection device 1. Signals and operating energy are transmitted by means of two coil pairs 2a', 2a'' and 2b', 2b'' between an interface 3 and the connection device 1. The interface 3 can be connected to the bus system of the motor vehicle. The respectively outer coils 2a'' and 2b'' are mounted on the steering column 30.

In the example, the coil pair 2a' and 2a'' serves for the transmission of signals by means of high frequency fields. The coil pair 2b' and 2b'' serves for the transmission of operating energy by

means of low frequency fields. The frequency ratio is of the order of magnitude of 100, so that the coil pairs 2a', 2a'' and 2b', 2b'' do not mutually influence each other.

#### Patent Claims

1. A device for the electric connection of elements, which are mounted on a rotating part of the steering mechanism of a motor vehicle, to the wiring of the motor vehicle by means of a transmission segment between a first part, which is connected to the rotating part of the steering mechanism, and a fixed second part, where the first part can be electrically connected to the elements and the second part can be connected to the wiring, wherein  
  
the first part has a connection device (1) with a suitable input and output unit (4), to which at least two of the elements can be mutually connected,  
  
the second part has at least one interface (3) for connection to the wiring (11) of the motor vehicle, and  
  
the connection device (1) and the interface (3) can be connected via the transmission segment (2) for the multiplexed transmission of signals.
2. The device of claim 1, wherein the transmission segment (2) is formed by means of at least one set of magnetic, mutually coupled electric coils (2a', 2a'', 2b', 2b''), of which

respectively a first coil (2a', 2b') can be connected to the connection device (1) of the rotatable part and respectively at least a second coil (2a'', 2b'') can be connected to the interface (3) of the fixed part.

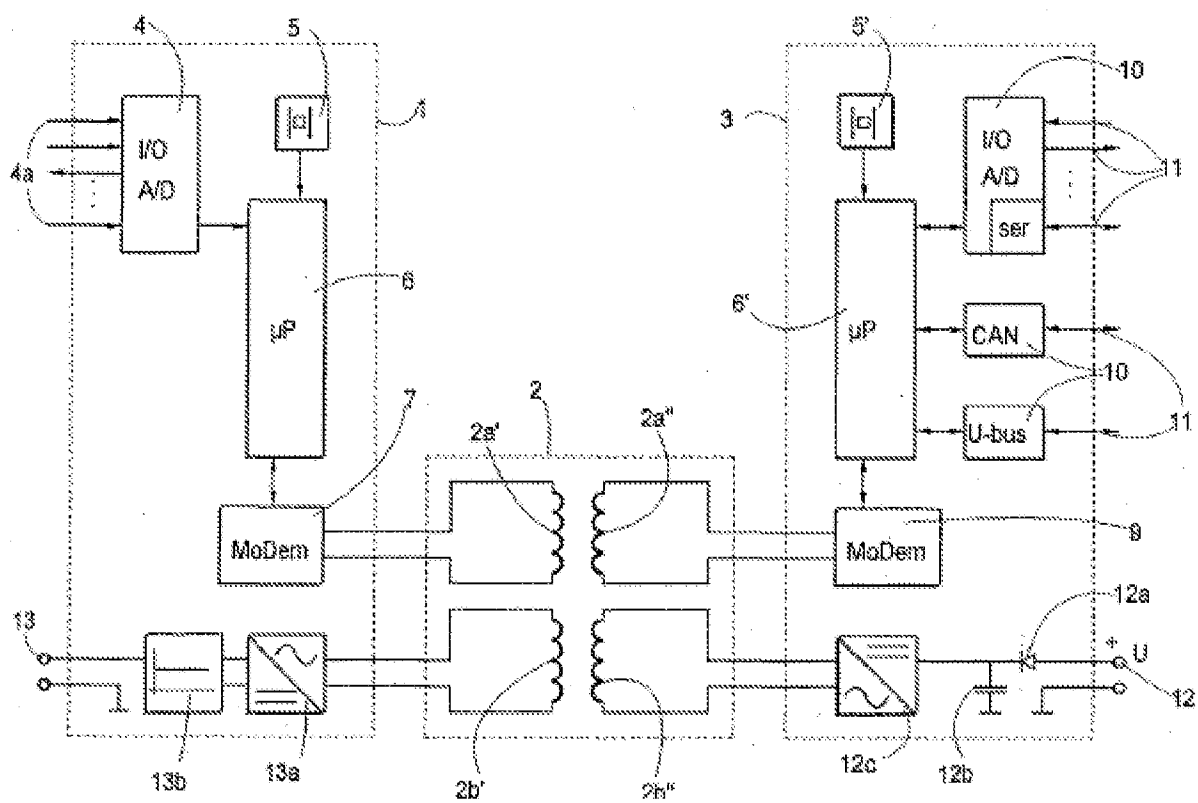
3. The device of claim 1, wherein the transmission segment has lines, whose respectively first end can be connected to the connection device of the rotatable part and whose respectively second end can be connected to the interface of the fixed part in such a way that the lines follow the rotary motion of the steering mechanism, for example, in that they are spirally wound around the steering column.
4. The device of one of the preceding claims, wherein, aside from signals, also operating energy can be transmitted via the transmission segment (2) between the rotatable and the fixed part, the interface (3) has connection possibilities (12) to the wiring of the motor vehicle, and the connection device (1) of the rotatable part has means (13) for making available the operating energy to the connected elements (27).
5. The device of claims 2 and 4, wherein signals and operating energy can be transmitted via the same coil set.
6. The device of one of the preceding claims, wherein the housing (24) of the airbag (26), which is integrated in the steering

wheel (25), the carrier (22) for a steering moment sensor (21), and the connection device (1) form one structural unit.

7. The device of one of the preceding claims, wherein the airbag (26) is provided with an energy store, which can be charged by means of the transmitted operating energy, and which contains the necessary energy for the ignition of the airbag.
8. The device of one of the preceding claims, wherein the interface (3) is configured for the transmission of digital signals.
9. The device of one of the preceding claims, wherein the interface (3) can be connected to the bus system (11) of the motor vehicle.

2 sheets of drawings are enclosed

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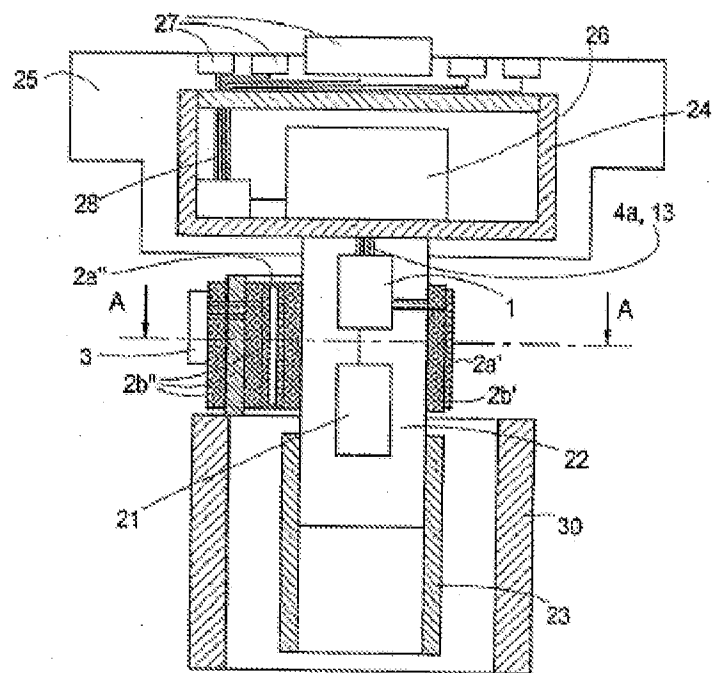


Fig.2

